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Tests of Circular Weirs

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in fatigue resistance when tested in a testing machine in the form of riveted joints than our plain low-carbon structural steels—a confirmation of the fact that many of these higher-strength steels may lack that intrinsic ductility required to relieve local over-strains.

Professor Wilson's preliminary studies explicitly point out the necessity of continued investigational work if we hope to find a really satisfactory high-strength steel for our future major structures. Such work cannot, however, be carried out without funds, and as the Committee today is not in a position to inaugurate such studies, it must remain a sort of committee-of-review of work accomplished by others until such time as funds are made available to enable it to proceed with a program of its own initiation.

ROBERT S. JOHNSTON, *Chairman*

Committee on Sewage Treatment Costs

THE Committee of the Sanitary Engineering Division on Sewage Treatment Costs has little progress to report —in part because of the demands on the time of the members by the current PWA program and other activities, and in part because of the magnitude of the project and the variety of factors which enter into the problem. Nevertheless, an effort has been made to determine the proper scope to be covered by the work of the Committee.

Two possibilities as to the scope of work have been suggested: (1) that the Committee should cover the broad field of the economics of sewage disposal, including costs of various sewage treatment procedures related to accomplishments; (2) that the Committee should cover the assembling of cost data, and the preparation of standardized forms for recording cost data, both construction and operation.

The Committee members favor activities in line with the first or broader scope. Accordingly, an outline has been prepared indicating some of the factors relating to, and affecting sewage treatment plant costs. These special factors have been grouped under four major divisions, as follows: (1) objectives and extent of sewage treatment, (2) sewage quantities and characteristics, (3) sewage treatment plant loadings, and (4) cost considerations.

The urgency with which many recent sewage disposal projects have been developed, and the efforts required to meet the various regulations imposed by federal aid have precluded as extended consideration as would normally be given to the relative merit and comparative costs of alternate project possibilities or the fundamental economics of the projects.

It would seem desirable, during the present period of unusual activity in the construction of sewage treatment plants, that an effort be made to record in comparable form the construction costs for a number of projects in various parts of the country. Sufficient data should be obtained to establish within reasonable limits the comparative construction costs for various types of plants and for various plant elements. Also some standard form for reporting operating costs would aid plant operators and public officials to report operating costs in a form that could be compared with similar data from other communities.

Comments or suggestions that would aid the Committee in its work would be heartily welcomed.

WILLIAM E. STANLEY, *Chairman*

R. A. ALLTON — GEORGE J. SCHROEPFER
PAUL HANSEN — A. H. WIETERS

Other Committees

Reports of the following committees have already appeared in CIVIL ENGINEERING: Committee on Technical Aspects of Refuse Disposal (March 1939); Special Committee on Hydraulic Research (February 1939).

Reports of a more technical nature were submitted by the Committee on Water Supply Engineering (Sanitary Engineering Division); and the Committee on Wind Bracing in Steel Buildings. The former was published in the March issue of PROCEEDINGS and the latter is being prepared for similar presentation in the near future.

ENGINEERS' NOTEBOOK

This department, designed to contain ingenious suggestions and practical data from engineers both young and old, should prove helpful in the solution of many troublesome problems. Reprints of the complete department, 8½ by 11 in., suitable for binding in loose-leaf style, are available each month at 15 cents a copy.

Tests of Circular Weirs

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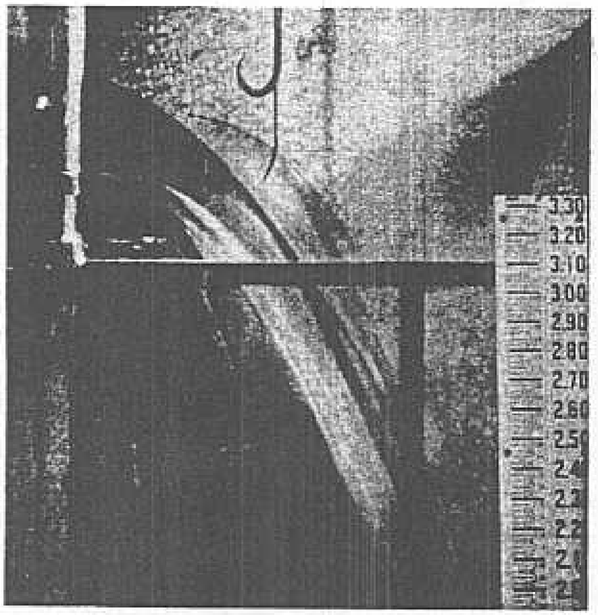
THE frequent use of drop inlet, or "morning glory" spillways has called attention to the need for information regarding the proper shape of the inlet below the crest. Data useful in this connection have been obtained in the laboratory of the Iowa Institute of Hydraulic Research by tests to determine the location of the upper and lower profiles of the nappe of a vertical sharp-crested weir, circular in plan. An empirical discharge formula for a circular weir has also been determined.

The tests were performed on weirs made of 10-gage steel plate having a top width of $^1/_{32}$ in. and a bevel on the downstream side at 60 deg with the horizontal. Each weir was shaped to form a circular arc having a chord length of approximately 18 in., and each had a height of about 3.5 ft (Fig. 1). Weirs having radii of 1, 2, and 3 ft were used and hence subtended central



DISCHARGE OVER CIRCULAR WEIR OF 3-FT RADIUS

angles of approximately 97, 44, and 29 deg, respectively. Radial side walls extended upstream from the weir a distance of three to four times the maximum head used and continued downstream to the point of convergence. A pyralin side wall was used downstream from the weir to permit observation of the nappe from the side.

Nappe profiles were measured by a combination hook and point gage mounted upon a carriage which was arranged to slide along a rigid horizontal beam. The beam was mounted above the weir so as to allow the gage to move in a vertical plane bisecting the arc of the weir crest.

Water was fed to the weir tank from a large constant-level tank which insured steady flow after stabilization at a particular head, and discharge measurements were made by weighing. At least two measurements of discharge and head were made on each run to check the constancy of flow. The under side of the nappe was aerated at all times. On the top side of the nappe, a roller built up at high heads causing a tailwater elevation greater than that of the crest. This roller formed when the head to diameter ratio exceeded 0.20 and caused a reduction in discharge.

The horizontal and vertical coordinates of the nappe, referred to the crest as the origin, were expressed in terms

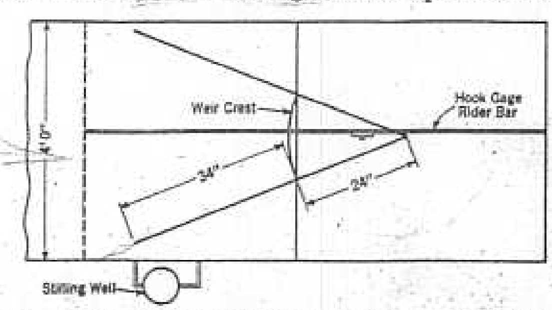


FIG. 1. PLAN OF CIRCULAR WEIR APPARATUS; 2-FT RADIUS WEIR INSTALLED

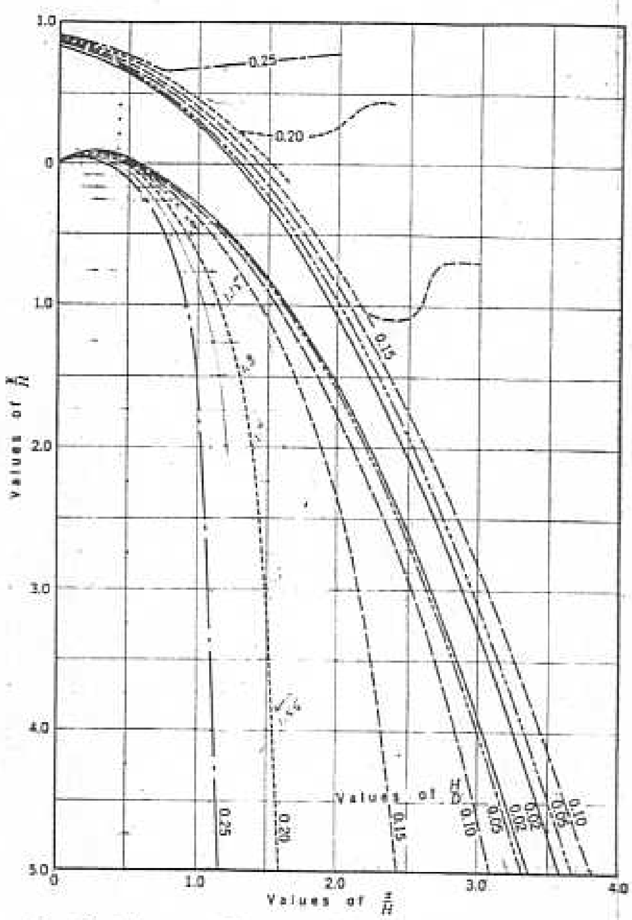


FIG. 2. SHAPE OF NAPPE FOR VARIOUS VALUES OF H/D
Origin of Coordinates Is the Weir Crest

of the head on the weir. Nappe profiles plotted in terms of these dimensionless coordinates proved to be practically identical for runs having the same ratio of head to diameter of weir arc, H/D, except in those runs in which the head was so low that the nappe adhered to the crest. Figure 2 shows upper and lower nappe profiles in terms of x/H and y/H for various values of H/D in the range covered by the experiments.

The coordinates of the high point of the lower nappe were found to be:

$$x/H = 0.26 - 0.40\ H/D \qquad [1]$$

$$y/H = 0.11 - 0.20\ H/D \qquad [2]$$

A logarithmic plot of discharge against head showed that nearly all the discharge measurements on the weirs could be represented by the equation,

$$Q = 3.28\ LH^{3/2} \qquad [3]$$

in which Q is the rate of discharge in cubic feet per second; L, the crest length in feet; and H, the head on the crest in feet. For a full circle of crest length, πD, Eq. 3 becomes,

$$Q = 10.3\ DH^{3/2} \qquad [4]$$

in which D is the diameter of the circle in feet.

Equation 3 gives results which agree with the experimental values within 1 per cent or less for values of H/D between 0.08 and 0.20. Larger errors than 1 per cent were found either side of this range, these errors being positive for lesser values of H/D and negative for larger values.

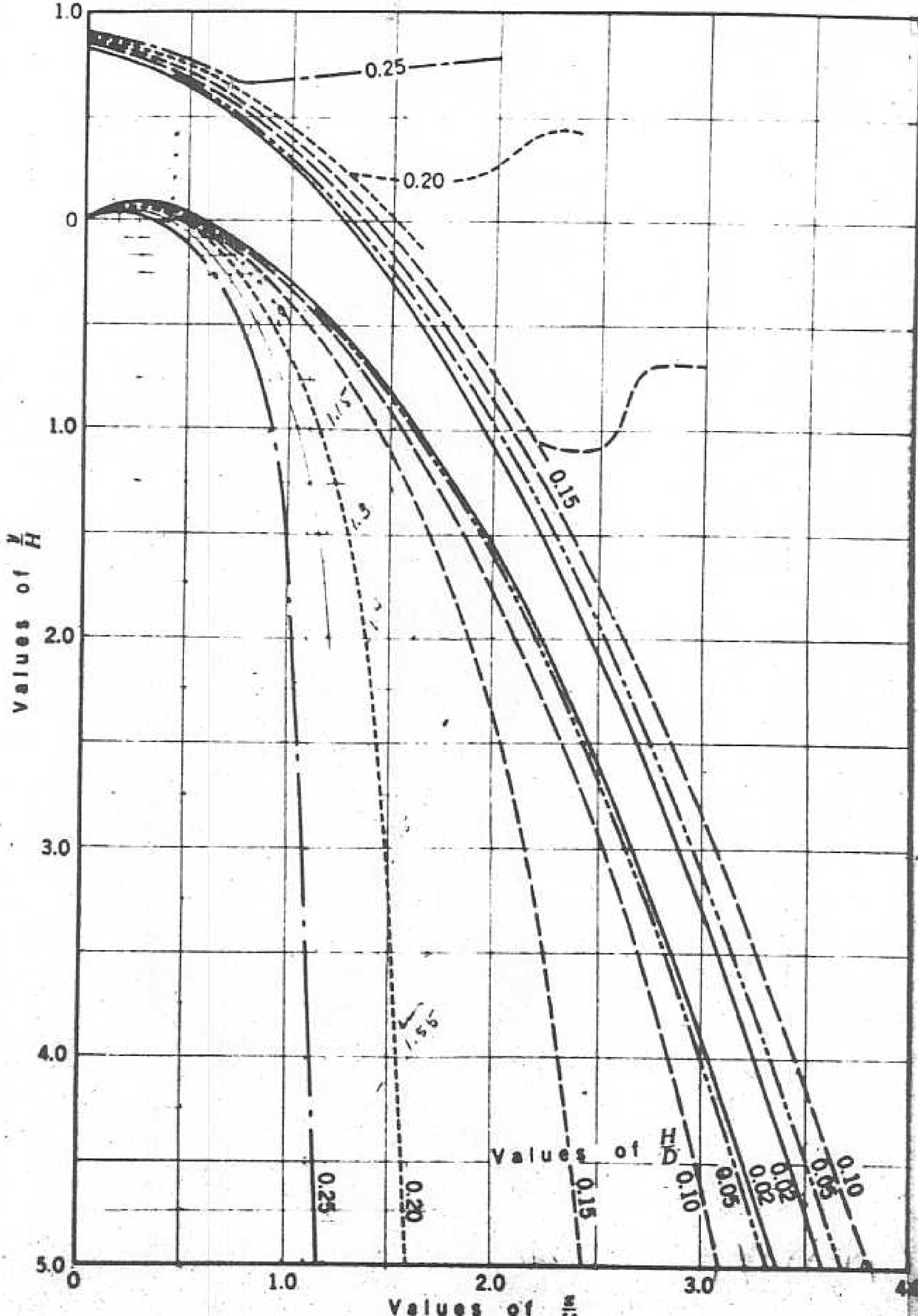


Fig. 2. Shape of Nappe for Various Values of H/D
Origin of Coordinates Is the Weir Crest